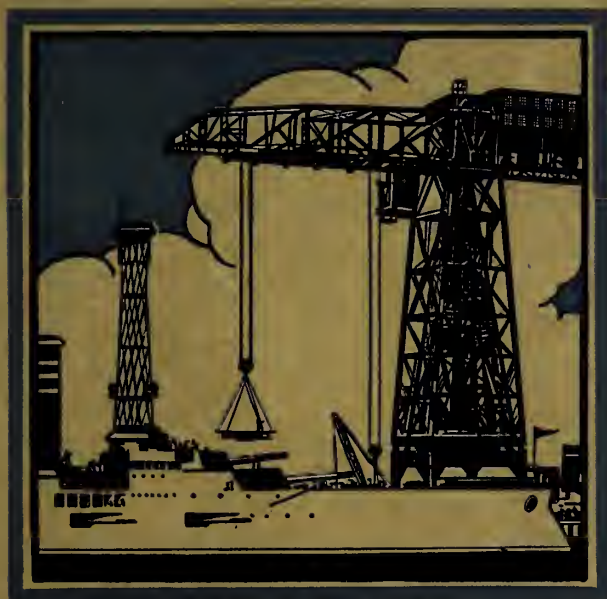


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INDUSTRIAL
POWER

GUIDE BOOK V — CHAPTER 1

ISSUED MAY, 1922

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BUSINESS DEVELOPMENT

INDUSTRIAL POWER GENERAL OUTLINE

GUIDE BOOK V — CHAPTER 1
ISSUED MAY, 1922

HEADQUARTERS
JOINT COMMITTEE FOR BUSINESS DEVELOPMENT
29 WEST 39th STREET
NEW YORK CITY

INTRODUCTION

ONE of the most important factors in the development of the electrical industry is the building up of the industrial power business. The Central Station will supply the electrical energy. Through the contractor dealer, handling the installation, the manufacturer will furnish the motors, controllers and other apparatus. The jobber will be called on for supplies and as industry expands more lighting equipment will be needed.

It is not necessary to point out that the development of the industrial power work need not originate with any one of the several allied branches. As each one has a particular interest that can be served only by the success of the whole, each should be alive to grasp any opportunity that presents itself, and go further than that by searching out opportunities. It often has been felt that this was the work of the Central Station but the whole activity may be increased many times if every one in the allied interests is keenly alert for the possibilities for additional business.

In this pamphlet we have touched briefly on a number of the industries where electric motor drive is particularly well adapted. It has not been the thought to make these anything more than suggestive, and as far as the reasons for the adoption of electrical energy goes, only a few of the high spots have been treated. It is the intention to follow this with much more exhaustive discussions of the various industries, showing the particular reasons why these industries should adopt electric drive, as well as the experience of manufacturers who are using it. Suggestions also will be offered regarding the methods that have proven most successful in interesting prospective users.

As has been suggested the development of the industrial power business must not be left to any one of the several interested groups. It is only through the sincere and cordial co-operation of all of the groups that the maximum results can be obtained.

Dir. G.

18 July 22

WHY POWER TO-DAY IS ELECTRIC POWER

TWENTY years ago, Central Station companies were selling practically no electricity for power purposes, while today there are probably five million Horse Power in electric motors in use in the United States from Central Station supply.

The electric motor is one of the very best machines in existence. Its efficiency and reliability are remarkable. The savings through the use of electric power have not been confined merely to manufacturers of larger and better generating units, but the development of the electric motor has been responsible for the tremendous reduction of frictional losses in factories, and has made possible the application of the mechanical drive where previously unfeasible.

Electric power has also made possible the huge development of the electro-chemical industry, in the manufacture of chemicals and synthetic articles of commerce.

Electric power has done much to speed up production. Particularly in the handling of materials is its influence forcibly felt. Much of the machinery at present in use for the handling of materials such as large traveling cranes, conveyors, loading and unloading devices, would have been impracticable, if not impossible, without electric power. In the actual manufacturing operations electric power has made quantity production possible to an extent unheard of before its use. This has been demonstrated on applications ranging from the large steel mill reversing motors to the small electrically driven sewing machine.

Chief among the advantages of convenience is the possibility of the use of central station power. This in turn leads to the following additional advantages: freedom of location, factory may be located anywhere within several miles of the central station; absence of noise, vibration, smoke, dirt, etc., which would come from the power plant in the factory building, additional productive capacity of employes due to cleanliness, comfort and good ventilation which is not always possible when a power plant is operating nearby; and the availability of supply at any moment, night or day.

During the war, the development of the use of electric heat-treating furnaces of all kinds, which resulted in the improvement of the quality of metals, could never have been accomplished in the same degree of efficiency as through the use of electricity. The development of the various types of electric furnaces for the melting of metals has worked a revolution in the particular lines of industry using these processes, during the last ten years, and we are just making a beginning.

Another field that has been conquered is the manufacture of artificial ice. Ten years ago there was not a pound of artificial ice manufactured in the City of Chicago through the instrumentality of electric power, whereas during the year 1921, 1,725,000 tons of ice and 8,000,000 gallons of ice cream were manufactured from Central Station electric supply.

The above outline indicates very clearly how closely the growth of communities depends upon the availability of cheap electric supply. Central Station companies have demonstrated during the last twenty years the necessity for the general use and distribution of electricity for every conceivable purpose, and within the last few years, the transmission lines, forming a network over the more thickly populated areas of the country, indicate that within a generation the dweller in suburban and farming communities can expect to have available the same electric supply as the larger communities, for any purpose.

Power today is Electric Power because it economizes in the use of raw materials, in space, in man power, and increases production.

STEAM POWER COMPETITION

ONE of the important features that is a part of the power salesman's duty is competition with proposed and existing steam plants. This resolves itself not into comparison of the actual operating costs alone but the cost of each type in its relation to the finished product. It may often be found that although the cost of central station service may be somewhat higher, the other advantages of that service such as increased output will show that the final cost per unit of manufactured product will be lower when central station service is used.

In making a comparison of the relative costs all operating and fixed charges of the private plant must be available. The operating costs for steam plant operation may be divided as follows:

1. Labor and attendance.
2. Fuel and water.
3. Oil, waste and supplies.
4. Repairs and maintenance.
5. Standby service.

The fixed charges may be divided into the following:

1. Interest.
2. Depreciation.
3. Taxes.
4. Insurance.
5. Superintendence.

The consumption of electrical energy may be determined by indicating the engine over a sufficient time to give average results under varying conditions of load and after deducting the power required to drive that part of the shafting that will be eliminated by the introduction of motors, the figure obtained should be checked by comparing this with the consumption of other factories operating under similar conditions.

When a comparison of the operating costs is obtained a careful study of the process of manufacture should be made. The trained power engineer will be able to detect objectionable features that may be eliminated if central station service is used and these points should be stressed in the report. It may be that he can show that output may be increased by a better routing of work through the shop which has not been possible to attain

with line shaft drive. Perhaps machines can be re-located to take advantage of better lighting conditions. It is possible that the output of the entire factory is regulated by the speed with which the work passes through one small department. As electric drive is so flexible, more machines may be installed in the same space that was limited in its producing capacity by an uneconomical machine arrangement made necessary by a rigid shafting layout.

The question of building heating and process steam is one that must be considered in practically every case of plant competition. Because exhaust steam is used for these purposes, it may appear that this will be a difficult handicap to overcome. It has been met successfully in the thousands of plants that have been shut down, however, and the advantages of low pressure boilers or gas fired boilers for process steam should be studied.

The difficulty of securing coal and the irregularity of the supply are frequently a deciding factor in obtaining the plant business.

Many other advantages are apparent with central station service, some of them peculiar to the particular plant under observation, so that a complete knowledge of operating conditions is essential in each case and the more detailed the study that is made the better are the chances for the introduction of electric power.

ELECTRIC POWER IN THE BAKING INDUSTRY

MANUFACTURERS of baking machinery as well as bakers themselves have not been slow to recognize the many advantages of electric drive. A great stride has been made in the application of electricity in the baking industry within the last few years, and present competition in this business makes it imperative that every economy must be taken advantage of.

Present day conditions make it necessary for every successful baker to maintain a high standard of cleanliness. It is difficult to obtain this condition where overhead belting and shafting are depended upon to transmit the necessary power. Then again the amount of power required in many instances is not sufficient to allow an economical power plant so the electric motor has come to the rescue.

The use of individually motor driven machines not only saves in operating costs but allows such arrangement of the machinery as to afford good lighting conditions and the proper sequence of operations with the maximum of efficiency. It is not uncommon for the baker to capitalize his equipment by soliciting an inspection by the public, in order to show his customers that modern equipment is being used and every precaution is being taken to obtain a clean product.

It is safe to say that bakeries which pass such an inspection must be using electric power.

Human hands need not touch the products necessary to make a loaf of bread. The flour is sifted, blended and measured automatically and dropped into motor-driven dough mixers from which the dough may be dumped into rising troughs. Then the dough divider cuts it into loaves and a motor driven belt conveyor takes it to the loaf rounder. After a short stay in the proving box it goes through motor driven molding machine and after the time required to "rise" in the pan the bread is ready for baking.

The automatic continuous process requires electric baking which has proved to be much superior to any other method. The bread baked in electric ovens has a better color and will remain fresh longer, as it is not dried out as it is in brick ovens. The electric oven takes up much less space and is very much less

in weight than the brick oven, this is important in the small bakery. The working conditions are more agreeable with the electric oven as all the heat is applied directly to the bread and not wasted in the work room.

Electric power has done the work, and a better and more uniform product is the result.

ELECTRIC POWER IN THE CLOTHING INDUSTRY

THERE is perhaps no industry in which electricity can be used to greater advantage than in the manufacture of wearing apparel. There has been considerable of an awakening to this fact and many clothing manufacturers are substituting up-to-date motor drives for belt drives.

One motor with a complicated system of belts and line shafts represents the old type of drive. Such a drive naturally has many disadvantages. The large number of belts reduce the lighting considerably which in itself is serious in this kind of work. Furthermore, the inefficiency of running a large motor when only a few machines may be required is apparent. Many belts and line shafts mean considerable upkeep and delays especially if anything happens to the main motor drive.

With motors direct connected to individual machines, practically all of the belting can be dispensed with, which will obviously also increase the efficiency of the lighting. In case of a breakdown on any particular machine, operation in the entire plant is not held up.

Power bills are decreased considerably because no power is wasted in driving heavy belts and line shafts on machinery that is not being used. Although individual motor drive does not necessarily eliminate all belting, it does cut down belting to a minimum so that this expense becomes very small.

Another point of importance is that a clothing factory equipped with individual motor drive is not subject to the dirt and oil coming from overhead belts and journal boxes. The elimination of overhead belts allows better circulation of the air and cuts down the liability of accidents since no exposed belts and pulleys are used.

Electricity, therefore, especially individual motor drive, increases production, reduces expenses, and improves working conditions. In addition to electric motors, electricity is extensively used for ventilating fans, electric irons, electric lighting, vacuum cleaning, etc.

ELECTRIC POWER IN THE METAL WORKING INDUSTRY

THE inherent advantages of electric motor drive are responsible for its increasing use in the metal working industry. A large variety of shops are necessarily included in the metal working classification referred to. These shops may be broadly classified into two groups—shops engaged principally in production work and shops equipped primarily for the maintenance and repair of equipment, for example, railway, locomotive and car shops. Electric drive has proved its value in both groups by reducing costs through increasing production or by lessening the time for repairs, thus keeping equipment in service a larger percentage of the time.

Increased production due to the heavy positive cuts possible with direct gear drive are apparent and the application of motors to all types of metal working machines has been very rapid.

While increased production due to positive drive remains the prime factor in the application of motors on metal working machines, other factors enter in. When a line shaft belt breaks a whole battery of machines loses time. If an individual motor is disabled, only one machine is idle. Lower power consumption due to elimination of friction in line shafts lowers overhead. Better lighting because of a clear ceiling and a cleaner, healthier shop is obtained by eliminating overhead shafting. The safety factor is increased enormously by the elimination of belts, and the maintenance of electrical equipment has proved to be lower than that of any other type of drive.

Earlier electrifications that involved the substitution of a single electric motor for another type of prime mover, proved economical but could not yield the full value that is gained by individual drive. Individual drive permits a realization of the greatest advantages of electric drive. Flexibility in locating machines, individual operation of units, with overload capacity, available when required and proper speed control for the individual machine result in the greatest degree where individual drive is used.

Some tools, for example planers, lend themselves to a design of motor and control equipment that eliminates all the troubles encountered with the older types of drive. The planer drive consists of a reversing motor and control equipment which drives the planer at a suitable speed during the cutting stroke, almost instantly reverses and drives on the return at a high speed. It has been found that this type of drive will actually increase the productive capacity of the tool approximately 30 per cent and permit much closer work than possible with the older types of belt drives.

Various other uses of power are found in the industry, such as electric arc welding which is saving many thousands of dollars every year in salvaging defective castings and forgings. Both arc and spot welding is gradually replacing mechanical riveting on many jobs because of the lower cost and better product attainable.

The larger plants in the automotive industry have been built during a period of increasing use of electric drive in the industries. The fact that these plants are approximately 85 per cent electrified, largely with individual drive, indicates the extent and importance of this type of drive as the best modern method of operating metal working tools.

ELECTRIC POWER IN THE MINING INDUSTRY

THE mining industry is generally "sold" on the use of electric power for all new installations, extensions and processes are planned on that basis, but that they are not entirely "sold" on purchased power is evidenced by the fact there are a great number of small and medium sized electric plants in operation, whose actual cost of making power is more than the cost at which it could be purchased. Of course, there are a number which use steam power. This is particularly true in the anthracite region. These two groups comprise the available possibilities where plants are already in operation. In some cases, where the larger generating plants are located at coal mines, it has been found profitable to both parties, for the power company to take over the existing unit. By this method, the cost of power can often be reduced and the load factor so much improved that a poor investment can be changed to a good one.

The application of electricity to the various uses connected with the mining industry is continually growing, and among some of the applications are the following:

- Drilling and cutting machines for breaking the original deposit to facilitate removal and recovery.
- Shovelling and loading machines.
- Shovels and cable systems for digging and loading. Locomotives and haulage systems.
- Pumps and pumping machinery.
- Signalling devices.
- Compressors for furnishing air for drills and other similar tools.
- Blowers.
- Hoisting engines.
- Crushing and pulverizing machinery for the reduction of the products of the mine to permit the recovery or use of same.

New applications which consume much power and make an attractive load are the electrolytic processes of the decomposition of copper and zinc; the electrification of shovels, in coal stripping operations, open pit iron mines, and low grade copper mines. In the mines where either compressed air haulage units or animals are used there is an ever-present opportunity to show an increase in tonnage and a reduction in operation and maintenance expense by use of electric haulage. In work formerly done almost entirely by steam equipment, such as yard-switching, large construction jobs, dredges, and drag lines for levee building and similar

work, electric equipment is now being used successfully and there are a number of other opportunities in similar applications.

Economy of operation is the basis on which equipment for the above applications is usually sold, and since purchased power can be shown to be the cheapest power and the most economical to install, these applications are opportunities. The economy of operation by electric power in these applications is proved by the fact that when once such an application is electrified, it is never changed back to steam.

The great advantage of the use of electric power in mining is the facility with which the power can be brought to the point where it is desirable and most convenient to apply it for direct use. As one example of this kind, we may mention the use of pumps for un-watering the mines. Electric power can be brought under ground and electrically driven pumps used with high efficiency and economy, whereas in the former methods a steam plant was necessary on the surface with long pipe lines leading to the pumps under ground and the exhaust lines, to say nothing of the very undesirable increase in temperature from the radiation of the heat from these lines.

The mining and electric industries are absolutely essential to each other. The power companies and electrical manufacturers use a very considerable percentage of the products of the mines, such as coal, copper and iron, and due to their existence make a market for a still larger percentage. On the other hand the mining industry offers a very attractive market for the product of electrical manufacturer and power company. There should, therefore, be close co-operation and mutual understanding between these two great industries.

ELECTRIC POWER IN THE PAPER INDUSTRY

THE paper industry stands sixth in the country in the value of annual products and in capital invested and probably fourth in primary horsepower installed. In the United States, there are 818 paper and 332 pulp mills, having an invested capital of about one billion dollars employing approximately 110,000 persons and having an output in 1920 valued at approximately \$1,025,000,000.

The superiority of electricity over steam or water as a motive power is now generally recognized by pulp and paper manufacturers. Years of experience with electric motors have proved conclusively that their use results in a decided increase in production, an improved quality of product and a decrease in operating cost.

As far as power problems are concerned motor drive removes all restrictions as to the location of the mill. With water power drive, the mill must be located near the dam, where all manufacturing conditions, such as the supply of labor and transportation facilities may be unfavorable, and where there is danger of floods. With electric operation, the plant may be located with proper regard for manufacturing and labor conditions because electric power can be transmitted economically.

With motor drive, the complex system of line shafts and heavy belts is eliminated and each machine can be placed wherever desired. Hence the plant can be laid out with a view to the demands of production and the efficient handling of materials and new machinery can be added without difficulty.

Each machine in a pulp and paper mill has a definite speed at which it will produce the maximum amount of the highest quality of a given grade of product. With motor drive, this speed can in each case be maintained at all times, because the speed of the motor is inherently uniform. With line shaft drive there are usually a number of belts between the engine or the water wheel and the driven machines, so that the amount of slippage under heavy load is considerable.

The use of meters measuring the input to individual motors driving various machines is of particular advantage. The meters will accurately indicate the finishing point of the stock and will

also show the conditions of wear of the machinery parts. Thus a more uniform product is assured than when the operators judgement is relied upon.

Control devices of various kinds can be furnished with motors, whereby they can be controlled from a convenient point and with little effort from the operator, this enabling him to give his entire attention to the work.

The safety of a mill is greatly increased by the use of motor drive. The belts and pulleys of line shaft are always a source of danger but with motor drive, all the driving mechanism can be enclosed or otherwise safeguarded. Safety switches, in connection with magnetic clutches or dynamic braking, stop the driven machines almost instantly, thus eliminating serious mishaps and greatly reducing the total number of accidents.

Because of the absence of line shaft and belts in a motor driven mill, there is less spoilage of stock by dirt and oil. The annual saving effected from this alone often amounts to a very large figure.

Motors require no regular attendants or licensed operators, little care, few repairs and practically no supplies. The elimination of most of the heavy belts reduces both the belt maintenance expenses and also the power losses.

The power demand in paper mills varies widely with the product manufactured, but in all cases a large amount of steam is required for drying the paper and also for heating the buildings in winter. The proper economical balance in the mechanical and thermal uses of steam is very important in this industry. Up to the point of obtaining the needed amount of low pressure steam, power may be obtained as a by-product from the use of fuel. For additional power, it will be found in many cases more economical to purchase electric current from a central station than for the mill to generate it. The steady 24-hour day demand of a paper mill renders it an attractive proposition for a central station and as a rule low rates can be obtained. By using some central station power in a new mill the investment expense of power house equipment and maintenance is kept down. Even in an old mill already equipped with a steam plant, it may be true economy to discontinue the use of the steam plant except so far as obtaining steam for drying and heating is concerned and disregard the investment already made. When utilizing central station power, the cost of operation of any machine or group is entailed only during the time the machinery is in service and the cost of running the machine is directly proportional to the amount of production.

ELECTRIC POWER IN THE TEXTILE INDUSTRY

THE textile manufacturers were among the first to appreciate the advantages of electric power for their mills and great progress has been made since the early installations.

The trend of improvement has been toward individual motor drive which is found in the modern mill from the picker room to the looms. The reasons for this are quite clear when questions of building construction, economical arrangement of machinery, the elimination of lint, dust and dripping oil, good lighting and positive control by the operator, over each machine, or small group of machines are considered. All these factors show advantages which are cumulative in their effect towards increasing production, and turning out a better product. In addition, the improved working conditions for the operator such as better light and air should not be forgotten.

The textile mill machinery is largely automatic and it is principally through improvement in machinery methods of applying power and in operating conditions, that advantages may be realized. The machinery designed to operate at a certain speed to give maximum output should have power applied as near as possible to the actual working point so as to eliminate all variable factors such as belt slippage, torsion of shafting, etc. The proper application of electric motors solves many of the speed troubles. In some processes such as driving ring spinning frames, the use of the adjustable speed motor with automatic control has resulted in increased production.

Power purchased from central stations has additional distinct advantages:

- (a) Low cost of power. Most central stations have adopted a schedule of power rates which are lower than the cost of power produced at the ordinary mill power house with steam engines.
- (b) Uninterrupted Service. One of the important requisites for a mill is that the power service should be continuous and available at all hours. The modern station has provided auxiliary machinery, switchboard protective devices, lightning protection for transmission lines and transformers so that former causes of interruption of service to mills have been largely eliminated and service is rarely interrupted. In addition, the service is available night and day, noon hour and Sundays, which is frequently necessary and always desirable at the mill.
- (c) Overload Capacity. The matter of temporary or permanent overload in a mill, often causing loss of speed and hence loss of production, is amply provided for by the reserve power of the large units at the central station. Overload is automatically taken care of by the station and the mill has the advantage and privilege of the addition or reduction of load at will.

- (d) Location of Mill. As the central station can bring its electric line to any location within its district, the manufacturer may locate solely with reference to the convenience of the manufacturer of the goods and the site convenient for water power, facilities for getting fuel supply, condensing water, etc., are factors which the manufacturer needs not consider.
- (e) Decreased Insurance. As the sub-station for power supply to a mill is located outside of the mill in a specially constructed house and as electric lines, motors and switches are all thoroughly protected with devices approved by both fire and liability insurance companies, and as steam engine boilers are eliminated as risks, the insurance including fire, liability, steam engine and boiler is materially reduced.
- (f) Cleanliness. As the central station service of transformers, wires, and motors, all of which are non-dirt and non-smoke producers, the mill is rid of dirt from coal handling, smoke from boiler house, dirt, dust and oil from large transmission shafting, pulleys and belts.
- (g) Power Supervision Simplified. The general supervision of the mill power plant, buying of fuel and supplies, making repairs and the necessary clerical work and bookkeeping are done away with.
- (h) Constant Voltage and Frequency. Inasmuch as it is an important part of the business of the central station to maintain a constant voltage and frequency, it is in a better position to assist textile manufacturers in their production by doing this. In most mill plants these are never maintained as they should be where the mill generates its own power.

While it is true that great advancements have been made in the use of electric power for textile mills, there are still many detailed problems to be solved before perfection is reached. Needless to say, however, that the present indications point to the more universal use of electric power for the solution of these problems.

ELECTRICITY FOR MATERIAL HANDLING—DOCK AND RAILROAD TERMINALS

THE necessity for the use of motor driven machinery for loading and unloading materials at docks and railroad terminals was never so thoroughly brought to the front and its importance so realized as during the War-time congestion.

Tremendous strides have since been taken to relieve this condition by the rapid replacement of old, inefficient man power by quick, tireless electric motive power.

Dock and terminal space is generally so valuable and limited that the use of steam power is practically out of the question. Electric power with its flexibility, economy and ease of control has allowed the extensive application of machinery to Material Handling.

Electrically operated machinery for handling such bulk materials as coal, ore and grain has been brought to a high state of development and a great many of the coast and lake ports are now so equipped. A tremendous saving in the time of loading and unloading vessels is thus obtained, with the resultant great saving in handling costs and docking charges. Coal and grain cars are picked up bodily, turned over and dumped into the hold of the waiting ship. Iron ore that comes down the lakes, is taken out of the boat very quickly and cheaply by the massive Hulett unloaders.

The use of electrically operated machinery for handling general merchandise, package freight and cargoes of various sizes and materials is relatively in its infancy and there is a great field for the adaptation of both new and already proven devices. In this field as in the case of bulk material handling, electric motors and controllers make possible economic handling of goods with a minimum operating force.

Motor operated belt and bucket conveyors will carry a continuous stream of goods to or from a ship. One application of this is the use of a portable bucket conveyor for coaling ocean liners. The chain buckets operate continuously, carrying the coal from the lighter directly into the coal bunkers. By this

process the length of time required for coaling is very much reduced. Conveyors are now being used to unload banana ships at the Southern ports and by their use the ship is released in much shorter time than if it is unloaded by hand.

Travelling and gantry cranes in railroad yards and on piers transfer material quickly and with a minimum of hand labor. Portable hoists are finding a wide use at Marine terminals. The hoisting mechanism, motors, controller and brakes, are mounted on a four-wheel truck. The complete equipment can then be moved along the dock to match up with the location of the ship to be unloaded. The cargo is hoisted out through the ship hatches, then dropped to the dock where storage battery trucks, or sometimes tractors and trailers, are available to carry the load away. This method eliminates much stevedore labor and the speed at which the unloading work can be carried on means that the ship is tied up at the dock for a much shorter time. Small motor driven hoists suspended from above, are used in railway freight terminals. These are sometimes used in connection with monorail systems and the freight is moved horizontally to the desired location. These monorail systems sometimes take the form of a container car in which numerous small packages are placed, with a platform on which the operator rides.

Many combinations and special types of machinery are needed to meet the various conditions of materials and space. To get the best results, several machines are often required, such as cranes for hoists for unloading the ships, trucks for carrying the material around the dock, elevators for hoisting the material to the proper level for storage and conveyors or stackers for moving it to its final location. The proper selection and application of these machines is an engineering problem of no small importance and due consideration should be given to the use of a well balanced system, using two or more different types in consequence instead of relying upon a single type to perform the complete handling operation.

It is only recently that the economies of such methods have begun to be appreciated. The saving in time and labor both mean a saving in cost, as it saves labor charges and releases ships and rolling stock for quicker "turn around" and greater revenue. It is estimated that the savings in the Port of New York on handling charges, by proper application of machines, would pay off the investment on this machinery in the first year.

Due to the present great congestion of dock and railroad terminals, the only hope for relief is in the greatest possible use of labor saving devices. And no other power can offer so many advantages such as safety, economy, speed and ease of handling, as electric power.

THE APPLICATION OF ELECTRIC HEAT IN INDUSTRY

INDUSTRIAL electric heating is coming into its own. It is no longer necessary to sit along the side lines and assume the attitude of watchful waiting to see if it is economically a success, since there are now a sufficient number of greatly diversified applications in successful operation, with manufacturing companies having world-wide reputations, to demonstrate conclusively that electric heat, properly applied, results in greater speed of production, better quality of product, and lower operating costs.

These conditions do not apply to any particular industry or geographic section. Neither are they characteristic particularly of the larger manufacturing companies, since it is equally important that the small manufacturer turn out a high grade product at a minimum cost. Many applications made in small plants show that fundamentally the same conditions exist there as in the larger plants.

The development of industrial heating apparatus in the past was not made on the basis of using fuels of low thermal cost, but for the purpose of obtaining a greater efficiency out of fuels having a higher thermal cost, giving at the same time a more uniform and better product. Witness the adoption of gas and oil in place of coal at ten times the thermal cost.

The price of the fuel used in a heating process may influence, but certainly does not determine, the cost of the completed product. The heating process, whatever it may be, is the most important part of the process, yet the cost of heating is usually a very small item of the total cost.

Electric heat, being of high thermal cost, must necessarily be applied efficiently, and due to its nature, can be applied in ways prohibitive with any other fuels. It may also be controlled to almost any degree of accuracy desired, and to conform to any desired cycle of operation, performing continuously and automatically. Electric heat permits of processes being carried out in an exact and definite manner, thereby securing uniform high grade results, and a duplication of these results day after day.

Many processes investigated, at first appeared to offer no opportunity for a reduction in cost or even approaching present costs, but upon studying the process more fully or in detail, astonishing savings have been made. The success of the application will depend largely upon the investigator. There is no reason why the product cannot be produced at a lower cost.

The potential industrial heating load is greater than the combined motor and lighting load. Apparatus is now available for electrifying approximately 60 percent of this tremendous load. Electrical manufacturers are placing trained specialists throughout the territory to assist in handling this work. Central stations are seeing the wisdom of having specially trained power salesmen on this work, and are sending their own men to the works of electrical manufacturing companies for the purpose of obtaining a prescribed course of intensive training in fundamentals of heating and application.

The era of electric industrial heating is upon us. It is up to each of us to give an account of our trust.

THE ELECTRIC VEHICLE

AT a conference of electric vehicle men and central station sales managers held during the past year the assertion was made that one of the reasons why electric trucks were not holding their own in competition with the gasoline truck was that they were not being sold properly.

And those who know the electric, with its economies of operation, its dependability, its simplicity, and its ease of control, are forced to the reluctant conclusion that this assertion is right. How else can one explain the fact that in the United States there are less than ten thousand electric trucks as compared with the hundreds of thousands of gasoline trucks? It is not because the gasoline truck is better. Where the gasoline truck and electric truck are operating in parallel lines of service in city transportation 80% of the gasoline trucks could be replaced by electrics to the betterment of transportation as a whole and to the profit of their users. Why have a truck with a speed capacity of thirty miles an hour when traffic conditions will hold it down to about ten?

While the selling methods to be employed by electric vehicle manufacturers will of course depend upon the manufacturers themselves the fact remains that the electric light and power companies can be of very great assistance acting either with the manufacturers or independently as selling agents. In either case, the return in revenue through the sale of current for charging electric vehicle batteries will more than repay the company for the efforts it puts forth.

The current used by storage battery vehicles makes a central station load which comes during the "off peak" period and in this is unlike most other current consuming devices.

Central stations throughout the country are beginning to go into the matter however and the success of their efforts is already attested by the purchase of new electrical transportation equipment and the discarding of useless or worn out trucks in many cities. In the city of Chicago the central stations derive an annual income of about \$800,000 from this source while in New York, where the public utility companies have actively promulgated the doctrine of electric trucks, the annual revenue exceeds \$1,000,000 and the number of kilowatt hours of electricity used for such service in this neighborhood is over 30,000,000 yearly. New York City uses as much current for charging purposes alone as

cities like Binghamton, N. Y., or Cambridge, Mass., use for lighting, power and all other purposes combined.

When the year 1921 had drawn to a close one manufacturer alone reported the sale of 80 electric trucks to the various central stations. The effect of such orders on the minds of those outside the industry cannot well be estimated in dollars and cents but it is subtly-working influence whose power is sure to be felt. Very often the central station man decides that a certain city or town is not suited to the application of electric trucks but finds, after a trial, that his idea was erroneous as an example, recently, in Worcester, Mass.

The American Railway Express Company placed 8 trucks with an aggregate capacity of 20 tons, in service there and have found them entirely satisfactory. These 8 trucks are adding \$260 per month to the current revenue of the central stations in Worcester and are a further proof of what the storage battery vehicle can do. Experience has brought home the value of electric trucks to the American Railway Express Company with such force that an order for 105 more electrics has just been placed, bringing the total number of electric trucks in use by this concern up to more than 1,225.

Attention of late has been drawn to the electric as a suitable vehicle for municipal bus lines and there can be no doubt that much would be gained in this way over the present type of city bus. By means of interchangeable battery units the mileage requirements could be met with no appreciable delay and the cost of operation when placed in service, would drive other types of busses off the streets for none can meet the electric in competition within its proper sphere.

Advertising by central stations is one of the methods by which the idea of electrical transportation can be clearly expounded to the public at large and it is entirely to the benefit of the central station to do this for the return is well worth the effort expended.

The use of electric trucks by central stations wherever possible is a profitable means of advertising and one which shows its effect most rapidly in increased profit to the lighting company. Electric trucks on the streets do more good than any other medium of publicity and impress themselves firmly on the mind of the prospective purchaser. At a recent convention of the N. E. L. A. Mr. Samuel Insull, President of the Commonwealth Edison Company of Chicago, said "I think it (the electric truck) is about the most profitable sale that we make as we have little or no cost to count, little or no depreciation and no concern about raising capital to take care of the increased business." Shortly afterward, he added, "in extending electric vehicle business you (central

station men) will extend your own business at a lower cost than you can any class of business that is placed on your circuits."

It is an economic shame that transportation costs are not investigated more fully by the average business man, because if this were done the manufacturer would be in all probability unable to fill his orders. So great an authority as Thomas A. Edison has made unqualified statements on the subject. At the Electric Vehicle Luncheon held in Chicago during 1921 in connection with the N. E. L. A. Convention, a telegram was received which read:

"I am pleased to learn that the electric vehicle for city traffic is receiving more attention lately from the electric lighting companies. Any merchant who keeps accurate costs will buy electrics."

(Signed) THOMAS A. EDISON.

Competent authority has asserted that 80% of all gasoline trucks in New York City could be profitably replaced by electrics. Consider what this means. There are at present 57,000 gasoline trucks in this district. Suppose not that 80% but that 28,500 or 50% of these were replaced by electrics. The average cash saving of electric vehicles has been determined at \$8 per day but in order to be sufficiently conservative let us say that the saving would not be \$8 but \$4. Multiplying 28,500 by \$4 we have \$114,000 which extended over three hundred yearly working days, becomes \$34,200,000 or the interest at 6% on \$570,000,000. In other words, the supposedly astute New York business man is allowing the interest on over half a billion dollars to slip through his fingers yearly. And this takes into account the monetary saving only, to say nothing of increased efficiency, relief of traffic conditions and added cleanliness plus the lowered fire, liability and theft insurance charges.

From every angle the electric vehicle should appeal to the central station and should prove of real benefit to the industry. The possible absorption market has scarcely been touched by the central station as yet although a very decided beginning has been made, and it is quite necessary that activity along these lines be not only continually maintained but greatly extended. In this work as in every other there is no time like the present and in connection with the N. E. L. A. slogan of "Electrify" for the coming years it would be well indeed if the Central Stations made a determined and united effort to promote the sales of electric vehicles to a much further degree than has previously been the case.

ELECTRIC POWER ON THE FARM

WHEN considering electric power in connection with the six and one-half million farms in this country, it is well to keep in mind that there are six and one-half million farm businesses as well as six and one-half million farm homes, since each farm, in addition to being the farmer's place of business, is also his home.

The general advantages of electricity are of relatively greater importance to the farmer in both his work and his home than is the case in the city shop or home because in the city steam engines and illuminating gas are usually available, while the farmer must depend on gas engines or kerosene, which have a limited application to his power requirements.

Farms vary in the nature of their activity just as do industrial plants. Some farms specialize in dairying, some in wheat, cotton, cattle or fruit on a large or small scale, similar to industrial specialization in machine shops, steel mills, shoe factories, cotton mills, etc. It can, therefore, be realized how power requirements vary on different kinds of farms. Every type and size of farm can use electricity to advantage either in the home or for doing farm work.

Safe, clean, convenient light is the outstanding need of any farm, since much chore work and adjusting of machinery and equipment for the day's field work must be done in the dark of the early morning or in the evening hours. The small amount of light from the oil lamp, the ever present danger of fire from the open flame and kerosene which is so serious on the farm away from fire protection, the time required to trim, fill and keep it clean as well as the fact that it must be carried from place to place and carefully guarded make the kerosene lamp far inferior to the safe electric light which can be remotely controlled and installed either outside or inside the buildings.

The use of automatically controlled electric lights in chicken coops, to increase egg production in the winter months and the use of electric bulbs for warming incubators and brooders are but a few of the many uses made possible by electric light on the farm.

There are many tasks on the farm requiring power that are now done manually. Dairy farms especially can use motors to replace man power by using motor driven churns, separators and milking machines. Watering stock is a time consuming job where a brook is the source of water supply and cows must be driven there twice a day. Where an engine is used to pump water, a storage tank must usually be provided which cannot always be kept clean. With an automatic pressure pump, fresh water can be pumped to the stock direct from the well as it is required, and the stock can be watered in their stalls. For irrigation, motor driven pumps can be remotely controlled which is also of considerable advantage.

Food grinding, ensilage cutting, and similar tasks can be done more profitably by means of an electric motor than by a gas engine because the motor is more readily portable, requires no heavy foundation, is simple in construction, easy to operate, cannot be easily injured, can be automatically controlled, requires no fuel or water and takes up little room. Motors enable the farmer to do many things he could not otherwise do for lack of time or power, as well as allowing him to make additional money by not paying a mill to grind his feed.

Electric light is so far superior to the dim, offensive smelling kerosene lamp that it needs no comment. Electric lights may be placed in the cellar, on the porch, or drive and controlled from a convenient place.

An automatic electric water pump makes a modern bathroom possible, and makes fresh water available in the kitchen and wash house. The electric iron is a boon to the farm wife since it is not necessary to have a hot fire in summer to heat the irons. The electric washing machine lifts a big burden from the farm woman as does the vacuum cleaner. Heating appliances such as percolators, toasters, and warming pads make farm life more enjoyable.

ENDORSEMENT—CO-OPERATION

AT the invitation of the National Electric Light Association, members of various electrical organizations and branches of the electrical industry met with the Association's officials on January 9th, 1922, to consider the organization of a combined movement for Business Development.

This was enthusiastically endorsed and, realizing that concerted action is essential, the Joint Committee for Business Development was organized with headquarters at 29 West 39th Street, New York City.

The electrical organizations and the leaders of the electrical industry are earnestly co-operating in this movement which has for its purpose no less an object than to Electrify America.

GUIDE BOOKS

The activities of the Joint Committee for Business Development are at present grouped under five general headings, or subjects. Each subject is the title of a Guide Book. Chapter 1 of each Guide Book has been issued in booklet form, as follows:

Guide Book I—Organization
Chapter 1—General Outline

Guide Book II—Lighting
Chapter 1—General Outline

Guide Book III—Appliances
Chapter 1—General Outline

Guide Book IV—Wiring
Chapter 1—General Outline

Guide Book V—Industrial Power
Chapter 1—General Outline

Chart of Activities of the Business Development Movement

